

PERANCANGAN PASSIVE TREATMENT (*LIMESTONE BED*) TERHADAP PENURUNAN PH, FE, DAN MN DI PT. X

Oleh :

Ivan Prayoga Pangestu

114200092

INTISARI

Indonesia memiliki sumber daya mineral yang melimpah, namun aktivitas pertambangan seperti batubara juga memunculkan tantangan lingkungan, salah satunya adalah air asam tambang (*acid mine drainage*) yang mencemari air dan tanah. PT. X menghadapi masalah ini di dua catchment area, yang selama ini dikelola menggunakan metode *liming injection*. Sebagai solusi alternatif yang lebih efisien dan berkelanjutan, penelitian ini dilakukan untuk menganalisis karakteristik air asam tambang (pH, Fe, dan Mn), mengevaluasi efektivitas sistem pengolahan pasif berupa limestone bed dalam skala laboratorium, serta merancang sistem yang sesuai dengan kondisi lapangan di PT. X.

Penelitian ini menggunakan metode kuantitatif untuk analisis kuantitatif dan kualitatif untuk interpretasi data. Data primer diperoleh dari survei, pemetaan, dan pengukuran di lapangan, sementara data sekunder berasal dari PT. X. Pengumpulan data meliputi survei kondisi lingkungan, *grab sampling*, uji laboratorium untuk pH, Fe, Mn, serta rancangan percobaan untuk menentukan waktu detensi optimal. Analisis dilakukan secara matematis dan deskriptif dengan membandingkan hasil terhadap baku mutu air berdasarkan Perda Kalimantan Timur No. 02 Tahun 2011.

Hasil penelitian menunjukkan pH inlet 5,89–6,78 dan outlet 6,02–7,08, dengan kadar Fe 0,04–0,17 mg/L dan Mn 1,14–2,20 mg/L, sesuai baku mutu. Limestone bed meningkatkan pH dari 5,89 menjadi 7,04 dalam 360 menit, serta menurunkan Fe sebesar 47,06% dan Mn 43,02%, memenuhi baku mutu dalam 120 menit. Perancangan sistem membutuhkan 1.190,65 ton batugamping, volume 3.774,21 m³, geomembrane 1.289,04 m², dengan estimasi biaya Rp586.729.262,-, disesuaikan dengan kondisi lapangan untuk efektivitas pengolahan.

Kata Kunci : air asam tambang, *limestone bed*, pengolahan pasif

PASSIVE TREATMENT (LIMESTONE BED) DESIGN TO REDUCE PH, FE, AND MN AT PT. X

By :

Ivan Prayoga Pangestu

114200092

ABSTRACT

Indonesia has abundant mineral resources, but mining activities such as coal also pose environmental challenges, one of which is acid mine drainage that pollutes water and soil. PT X faces this problem in two catchment areas, which have been managed using liming injection. As an alternative solution that is more efficient and sustainable, this research was conducted to analyse the characteristics of acid mine drainage (pH, Fe, and Mn), evaluate the effectiveness of a passive treatment system in the form of a limestone bed on a laboratory scale, and design a system that is suitable for field conditions at PT X.

This study employs quantitative methods for numerical analysis and qualitative methods for data interpretation. Primary data were obtained through surveys, mapping, and field measurements, while secondary data came from PT. X. Data collection includes environmental surveys, grab sampling, laboratory tests for pH, Fe, and Mn, and experimental design to determine the optimal detention time. Data analysis was conducted mathematically and descriptively, comparing the results with water quality standards based on East Kalimantan Regional Regulation No. 02 of 2011.

The study results indicate that the pH of the inlet ranges from 5.89 to 6.78, while the outlet ranges from 6.02 to 7.08, with Fe concentrations of 0.04–0.17 mg/L and Mn concentrations of 1.14–2.20 mg/L, meeting quality standards. The limestone bed increased pH from 5.89 to 7.04 within 360 minutes and reduced Fe by 47.06% and Mn by 43.02%, achieving compliance within 120 minutes. The system design requires 1,190.65 tons of limestone, a volume of 3,774.21 m³, and 1,289.04 m² of geomembrane, with an estimated cost of Rp586,729,262, adjusted to field conditions for optimal treatment effectiveness.

Keywords : acid mine drainage, limestone bed, passive treatment